IS 3722-1 (1983): Letter symbols and signs used in electrical technology, Part 1: General guidance on symbols and subscripts [ETD 1: Basic Electrotechnical Standards]

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IS : 3722 ( Part 1 ) - 1983
( Reaffirmed 2002 )

# *Indian Standard*

# LETTER SYMBOLS AND SIGNS USED IN ELECTRICAL TECHNOLOGY

## PART 1 GENERAL GUIDANCE ON SYMBOLS AND SUBSCRIPTS

## *( First Revision )*

First Reprint SEPTEMBER 1997

UDC 621.3.011 : 003.62



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NEW DELHI 110002

Gr 5 *March* 1984

# *Indian Standard*

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## PART 1 GENERAL GUIDANCE ON SYMBOLS AND SUBSCRIPTS

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## 0. FOREWORD

**0.1** This Indian Standard ( First Revision ) ( Part 1 ) was adopted by the Indian Standards Institution on 27 May 1983, after the draft finalized by the Electrotechnical Standards Sectional Committee had been approved by the Electrotechnical Division Council.

**0.2** Quantities and units used in electrical technology cover, in addition to electricity, magnetism, radiation and light, other subjects such as geometry, kinematics, dynamics and thermodynamics. As technology reaches greater levels, several disciplines interact with the result that terminology used in one discipline becomes closely interrelated with that of the other. The letter symbols used in abbreviations for denoting quantities, their functions and units, therefore would have to be standardized in order to enable uniform understanding of the meaning they represent.

**0.3** Realising the need, this standard was originally brought out in 1966, essentially to cover symbols for quantities and units. The present revision is being brought out with a wider scope, including rules for subscripts, rules for denoting numerical values etc. This revision, for ease of reference, is being brought out in two parts:

Part 1 General guidance on symbols and subscripts
Part 2 Reference tables for symbols and subscripts

It is felt that while Part 1 essentially would provide guidance on choice of symbols and subscripts with the associated logic, Part 2 would serve as a ready reference on the various quantities and units. These Parts shall therefore be read in conjunction with each other.

**0.4** In this standard the units are given in the SI units ( the International Systems of Units ). This system is based on the following six basic units:

| | |
|---|---|
| metre ( m ) | ampere ( A ) |
| kilogram ( kg ) | kelvin ( K ) |
| second ( s ) | candela ( cd ) |

as units for the basic quantities of length, mass, time, electric current, temperature, and luminous intensity. For some of the quantities, like, conductance and magnetic flux density, the units are given, besides in SI units, also in more familiar units in use in the country. However, it should be noted that the latter units are not necessarily equivalent to the SI units.

**0.5** A large number of symbols for the quantities and units covered in this standard employ letters of Greek alphabet. Therefore, a complete list of Greek letters has been given in Appendix A.

**0.6** A Glossary of terms concerning letter symbols has been added ( *see* Appendix B ) in order to provide guidance on concepts relating to the formation of letter symbols.

**0.7** In the preparation of this standard, considerable assistance has been derived from IEC Pub 27-1 ( 1971 ) 'Letter symbols to be used in electrical technology: ( Part I ) General', issued by the International Electrotechnical Commission.

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## 1. SCOPE

**1.1** This standard covers letter symbols and signs for quantities used in electrical technology and their units.

**1.2** This standard ( Part 1 ) covers rules for symbols and subscripts.

## 2. SYMBOLS FOR QUANTITIES

**2.1 Choice of Alphabet** — Symbols for quantities shall be single letters of the Latin or Greek alphabet, sometimes with subscripts or other modifying signs.

**2.2 Choice of Type** — Symbols for quantities are printed in italic ( sloping ) type. For special needs appropriate means such as script may be used.

NOTE — It is recommended as a guiding principle for the printing of subscripts that, when these are symbols for quantities or for running numbers, they should be printed in italic ( sloping ) type.

*Examples:*

$C_p$ heat capacity at constant pressure $p$

$F_x$ $x$-component of force

$\sigma_{xy}$ $x$, $y$-component of a stress tensor $\sigma$

$a_n$ coefficient with $n$ = 1, 2, 3 . . .

All other subscripts shall be printed in roman ( upright ) type.

*Examples:*

| | |
|---|---|
| $C_g$ | heat capacity in the gas phase |
| $\mu_r$ | relative permeability |
| $B_i$ | intrinsic magnetic flux density |
| $N_A$ | Avogadro constant |
| $m_e$ | rest mass of the electron. |

NOTE — It is recognized that on many occasions it will be unnecessary or undesirable to adhere to this principle, in these cases the same type should be used consistantly for all subscripts.

## 2.3 Vector Quantities

**2.3.1** For indicating the vector character of a quantity, bold face italic type for letter symbols are recommended ( for example $\boldsymbol{H}$ ). If such type is not available, an arrow may be placed over the letter symbol ( for example $\vec{H}$ ).

## 2.4 Quantities which Vary with Time

**2.4.1** Quantities which vary with time may be indicated as follows:

Case 1 applies if capital and lower-case letters are appropriate,

Case 2 applies if only capital or only lower-case letters are appropriate.

| | Case 1 | Case 2 A | Case 2 B |
|---|---|---|---|
| Instantaneous value | $x$ | $X$ | $x$ |
| Root-mean-square value of a periodic quantity ( *see* Note ) | $X$ | $\tilde{X}$ $X_{\mathrm{rms}}$ | $\tilde{x}$ $x_{\mathrm{rms}}$ |
| Peak value | $\hat{x}$, $\hat{X}$ or $x_{\mathrm{m}}$, $X_{\mathrm{m}}$ | $\hat{X}$ or $X_{\mathrm{m}}$ | $\hat{x}$ or $x_{\mathrm{m}}$ |
| Average value ( *see* Note ) | $\bar{x}$, $\bar{X}$ or $x_{\mathrm{av}}$, $X_{\mathrm{av}}$ | $\bar{X}$ or $\bar{X}_{\mathrm{av}}$ | $\bar{x}$ or $x_{\mathrm{av}}$ |

NOTE — *See* also Table 4 of IS : 3722 ( Part 2)-1983*.

The minimum value of a quantity may be indicated by $\check{x}$, $\check{X}$ or $x_{\mathrm{min}}$, $X_{\mathrm{min}}$, so that the peak-to-valley value is $\left(\hat{x} - \check{x}\right)$ or $\left(\hat{X} - \check{X}\right)$ and $( x_{\mathrm{m}} - x_{\mathrm{min}} )$ or $( X_{\mathrm{m}} - X_{\mathrm{min}} )$.

*Letter symbols and signs used in electrical technology: Part 2 Reference tables for symbols and subscripts ( *first revision* ).

**2.5 Complex Representation of Quantities** — Complex representation of quantities may be indicated as follows, both systems being on an equal footing.

| | | |
|---|---|---|
| Real part | $X'$ | $\mathrm{Re}\, X$ |
| Imaginary part | $X''$ | $\mathrm{Im}\, X$ |
| Complex quantity | $\underline{X} = X' + \mathrm{j}X''$ | $\underline{X} = \mathrm{Re}\, X + \mathrm{j}\, \mathrm{Im}\, X$ |
| | $\underline{X} = X\, \mathrm{e}^{\mathrm{j}\varphi}$ | $\underline{X} = \lvert X \rvert\, \mathrm{e}^{\mathrm{j}\varphi}$ |
| | $= X \; \exp \mathrm{j}\varphi$ | $= \lvert X \rvert \exp \mathrm{j}\varphi$ |
| | $\underline{X} = X \angle \varphi$ | $\underline{X} = \lvert X \rvert \angle \varphi$ |
| Conjugate complex quantity | $\underline{X} = X' - \mathrm{j}X$ | $X^* = \mathrm{Re}\, X - \mathrm{j}\mathrm{Im}\, X$ |

**2.6 Symbols for Quantities** — *see* Table 2 of IS : 3722 ( Part 2 )-1983*.

**2.7 Combination of Symbols for Quantities ( Elementary Operations with Quantities )**

**2.7.1** When a compound quantity is formed by multiplying several other quantities, the symbol for it may be written in one of the following ways:

$$ab \qquad a\ b \qquad a{\cdot}b \qquad a.b \qquad a \times b$$

**2.7.2** When a compound quantity is formed by dividing one quantity by another quantity, the symbol for it may be written in one of the following ways:

$\dfrac{a}{b}$ $a/b$ or by writing the product of $a$ and $b^{-1}$

The procedure can be extended to cases where the numerator or the denominator, or both, are themselves products or quotients, but in no case should more than one solidus ( / ) on the same line be included in such a combination, unless parentheses be inserted to avoid all ambiguity. In complicated cases negative powers should be used.

*Examples:*

$$\frac{ab}{c} = ab/c = a\ b\ c^{-1}$$

$$\frac{a/b}{C} = (\ a/b\ )/c = ab^{-1}c^{-1} \text{ but not } a/b/c\text{; however } \frac{a/b}{c/d} = \frac{a\ d}{b\ c}$$

$$\frac{a}{bc} = a/bc$$

*Letter symbols and signs used in electrical technology: Part 2 Reference tables for symbols and subscripts ( *first revision* ).

The solidus can also be used in cases where the numerator and the denominator involve addition or subtraction. If there is doubt as to where the numerator starts and the denominator ends, parentheses should be used.

*Example:*

$$( a + b )/( c + d ) \text{ means} \frac{a + b}{c + d}$$

however, if $a + b/c + d$ is written, it means $a + \frac{b}{c} + d$

Parentheses should also be used to remove ambiguities which may arise from the use of certain other signs and symbols for mathematical operations.

**2.7.3** In the case of vectors the sign · ( half-high dot ) is used for the scalar product ( for example $\boldsymbol{A} \cdot \boldsymbol{B}$ ) and the sign × ( cross ) for the vector product ( for example, $\boldsymbol{A} \times \boldsymbol{B}$ ).

**2.8 Substitution of Letters**

**2.8.1** Capital letters may be used as variants for lower-case letters ( and vice versa ), only if no ambiguity could result.

**2.8.2** The chief symbol for length is $l$ and for inductance $L$, but $l$ and $L$ may also be used together for two lengths or two inductances. If length and inductance appear together, then $l$ should preferably be used only for length and $L$ for inductance and any necessary distinction should be made by means of subscripts.

## 3. SYMBOLS FOR UNITS

**3.0 General**

**3.0.1** Symbols for units are written in lower-case ( small ) letters, except the first letter when the name of the unit is derived from a proper name. They remain unaltered in the plural and are written without a full stop ( period ).

**3.1** Any attachment to a unit symbol as a means of giving information about the special nature of the quantity under consideration is incorrect. Distinguishing subscripts such as 'e' for 'electrical', 'th' for 'thermal' can be attached only to quantity symbols; thus none of the expressions 20 MWe or 20 MW (e) may be used to indicate that $P_e$=20 MW.

Abbreviations should not immediately follow a unit symbol. For example, instead of '115 V ac', use 'ac: 115 V', or preferably '~115V', which is independent of language.

**3.2 Choise of Type** — Symbols for units are printed in roman ( upright ) type, irrespective of the type used in the text.

**3.3 Symbols for Units** — *see* Table 1 of IS : 3722 ( Part 2 )-1983*.

**3.4 Combination of Symbols for Units**

**3.4.1** When a compound unit is formed by multiplying several other units, its symbol may be written in one of the following ways ( *see* Note given in **3.5.1** ):

Nm N m N·m N.m

**3.4.2** When a compound unit is formed by dividing one unit by another, its symbol may be written in one of the following ways:

$\frac{m}{s}$ m/s or by writing the product of m and $s^{-1}$

In no case should more than one solidus ( / ) on the same line be included in such a combination, unless parentheses be inserted to avoid all ambiguity. In complicated cases negative powers or parentheses should be used, for example W/( sr.m$^2$ ).

**3.5 Prefixes Indicating Decimal Multiples or Submultiples of Units**

**3.5.1** Given below are the prefixes indicating multiples and submultiples of units:

| *Miltiple* | *Prefix* | *Symbol* |
|---|---|---|
| $10^{12}$ | tera | T |
| $10^{9}$ | giga | G |
| $10^{6}$ | mega | M |
| $10^{3}$ | kilo | k |
| $10^{2}$ | hecto | h |
| 10 | deca | da |
| $10^{-1}$ | deci | d |
| $10^{-2}$ | centi | c |
| $10^{-3}$ | milli | m |
| $10^{-6}$ | micro | $\mu$ |
| $10^{-9}$ | nano | n |
| $10^{-12}$ | pico | p |
| $10^{-15}$ | femto | f |
| $10^{-18}$ | atto | a |

NOTE — When a symbol for a prefix coincides with the symbol for a unit, special care should be taken to avoid confusion. The newton-metre ( unit for torque ) should be written, for example, Nm or m·N to avoid confusion with mN, the millinewton.

*Letter symbols and signs used in electrical technology : Part 2 Reference tables for symbols and subscripts ( *first revision* ).

**3.5.2** Symbols for prefixes shall be printed in roman type, without space between prefix and the symbol for the unit.

**3.5.3** Compound prefixes are not recommended.

**3.5.4** When a symbol representing a unit which has a prefix carries an exponent, this indicates that the multiple ( or submultiple ) unit is raised to the power expressed by the exponent.

*Examples:*

$$1\ \mathrm{cm}^3 = 1\ (\ \mathrm{cm}\ )^3 = (\ 10^{-2}\mathrm{m}\ )^3 = 10^{-6}\mathrm{m}^3$$

$$1\ \mu\mathrm{s}^{-1} = 1\ (\ \mu\mathrm{s}\ )^{-1} = (\ 10^{-6}\mathrm{s}\ )^{-1} = 10^{6}\mathrm{s}^{-1}$$

## 4. NUMERICAL VALUES ( NUMBERS )

**4.1 Choice of Type** — The digital representation of numerical values should generally be printed in roman ( upright ) type.

**4.2 Spacing of Groups of Digits** — To facilitate the reading of numbers with many digits, these may be separated into suitable groups, preferably of three, counting from the decimal sign towards the left and the right; the groups should be separated by a small space but never by a comma or by a point or by any other means.

**4.3 Decimal Sign** — A dot or a full point is used as the decimal sign. If the magnitude of the number is less than unity, the decimal sign should be preceded by a zero.

**4.4 Multiplication Sign** — The sign for multiplication of numbers is a cross or a dot. Since a dot is used as the decimal sign ( *see* **4.3** ) a dot similarly placed should not be used as the multiplication sign.

**4.5** Examples of correct representation of numerical values are given in Appendix C.

## 5. RULES FOR SUBSCRIPTS

### 5.0 Purpose of Subscripts

**5.0.1** When, in a given context, different quantities have the same letter symbol or when, for one quantity, different applications or different values are of interest, distinguishing means, such as subscripts, are necessary. This clause gives rules for the choice of these distinguishing means. The rules are so derived as to make the complete symbols independent of the language of the document in which they occur.

The subscripts dealt with here are those placed below the line on the right-hand side of a letter symbol and usually printed in smaller type. The other distinguishing means dealt with here are only those contained

in preceding clauses; other additional marks, such as superscripts, are under consideration.

**5.1 General**

**5.1.1** In most cases, subscripts should be used as distinguishing means but in some cases other distinctions such as typographical signs or variants in type are suitable.

**5.1.2** In a few cases, it is permissible to use different but related letter symbols. The examples are as given below:

a) *Subscripts:*

Magnetic flux density in vacuo $B_0$

Intrinsic magnetic flux density $B_i$

Current in different conductors $I_a$, $I_b$, $I_c$ etc

Minimum value of frequency $f_{min}$

b) *Type variants:*

Instantaneous value of current $i$

Root-mean-square value of current $I$

Force vector $\boldsymbol{F}$

c) *Typographical Sign:*

Peak value of current $\hat{i}, \hat{I}$

d) *Different but related letter symbols:*

Three different angles $\alpha$ $\beta$ $\gamma$

**5.2 Rules**

**5.2.1** *Order of Preference* — Subscripts and other distinguishing means that are independent of language ( *see* **5.2.2** ) and subscripts of international character ( *see* **5.2.4** ) should, as far as possible, be chosen in preference to other subscripts ( *see* **5.2.4** ).

**5.2.2** *Subscripts and other Distinguishing Means which are Independent of Language*

**5.2.2.1** *Subscripts* — Subscripts that are independent of language may be numbers, mathematical symbols and signs, sequences of letters, reference letters, letter symbols for quantities and units and symbols for chemical elements.

a) *Numbers* — Numbers may represent for instance; order, degree of importance, and reference. The subscript 0 ( zero ) is used not only as a number, but also for basic, initial, or reference conditions.

Roman numerals as subscripts should be used sparingly.

The letter ' l ' and the numeral ' 1 ' are often identical.. Care should be taken to avoid ambiguity.

*Examples* :

$i_1\, i_2\, i_3$ the first second, and third harmonic components of a current; or current in conductors 1, 2 and 3, or current in the same conductor at three different moments

$R_{50}$ resistance at a temperature of 50°C

$R_{50}$ resistance at a frequency of 50 Hz

$U_{99}$ sparkover voltage with 99% probability

b) *Mathematical signs*

*Example* :

$i_\infty$ current at infinite time

c) *Sequence of letters* — There are occasions when samples of the same physical quantity that are classified in a sequence may be distinguished by letter subscripts rather than by number subscripts. Both capital and lower-case letters may be used, but lower-case letters are preferred.

*Examples* :

$Q_{\mathrm{a}}\, Q_{\mathrm{b}}\, Q_{\mathrm{c}}$ three different electric charges

d) *Reference letters* — The subscript indicates the applicability of a symbol in some way, for instance restrictions to particular location, points of time, pieces of apparatus or parts of apparatus, processes, substances, fields ( electrical, mechanical, etc ). The following few examples illustrate the point.

*Examples* :

$E_{\mathrm{B}}$ could denote electric field strength at point B

$S_{\mathrm{EF}}$ could denote length of path from point E to point F

$A_{\mathrm{KLM}}$ could denote the area of a triangle with the corners K, L and M

$I_{\mathrm{u}}$ could denote current in phase u

e) *Quantity or unit symbols used as subscripts* — A letter symbol for a quantity ( or for a unit ) when used as a subscript, shall be printed in the same style as when used as a quantity symbol ( or as a unit symbol ).

*Examples*:

$C_p$ heat capacity at constant pressure $p$

$\delta_C$ loss angle of capacitor of capacitance $C$

$W_{3h}$ energy capacity of a battery at three hours ( 3h ) discharge

f ) *Symbols for chemical elements* — Internationally adopted symbols for chemical elements are independent of language and may be used as subscripts.

*Example* :

$\varrho_{Cu}$ resistivity of copper ( Cu )

**5.2.2.2** *Other distinguishing means* — For distinguishing between different types of values, for example, instantaneous value, root-mean-square value, peak value, minimum value, average value, capital and lower-case letters and some signs ( $\wedge$ $\vee$ $\sim$ — ) should be used as recommended in **2.4**. Recommendations for vector quantities are given in **2.3** and for complex representation of quantities are given in **2.5**.

*Examples* :

$i$ instantaneous value of current

$I$ root-mean-square value of current

$\tilde{Q}$ average value of electric charge

$\hat{\phi}$ peak value of magnetic flux

$\vec{H}$ magnetic field strength as a vector

$\varepsilon'$ real part of complex permittivity ( complex capacitivity )

**5.2.3** *Subscripts of International Character*

**5.2.3.1** *Proper names* — Abbreviations of proper names are, with extremely few exceptions, the same or practically the same in all languages. Such abbreviations are, therefore, of international character, and they may be used as subscripts.

*Examples* :

$T_C$ Curie temperature

$R_H$ Hall coefficient

**5.2.3.2** *Words derived from Latin and Greek* — Latin and Greek serve as a basis for most scientific and technical words, and abbreviations of such words are suitable as subscripts.

*Examples* :

$P_{el}$ electrical power

$P_{cr}$ critical pressure

$v_{\mathrm{i}}$ initial velocity
$B_{\mathrm{i}}$ intrinsic magnetic flux density
$T_{\mathrm{ext}}$ external thermodynamic temperature
$R_{\mathrm{eq}}$ equivalent resistance
$g_{\mathrm{n}}$ standard (normal) acceleration of free fall
$M_{\mathrm{v}}$ luminous (visual) exitance

**5.2.3.3** *International words not derived from Latin and Greek* — Many words, which have been coined for scientific and industrial purposes have an international character. Examples of such words are gas, radar, maser. Abbreviations of such words are suitable as subscripts.

*Example* :

$C_{\mathrm{g}}$ heat capacity in the gas phase

**5.2.4** *Other Subscripts* — If it is not possible in a specific case to find Latin, Greek, or other international words from which to derive an acceptable subscript, arbitrarily chosen letters or numbers are preferred. If such a choice is not convenient, subscripts derived from words that are common to many languages are the next best choice.

**5.2.5** *Some Observations* — When a subscript is not self-explanatory, its meaning should be stated.

Subscripts, whether they conform to these recommendations or not, may be ambiguous; thus i ( roman, upright ) may mean initial, induced or intrinsic. Ambiguity can often be avoided by the use of longer subscripts, as ini for initial, ind for induced, and intr for intrinsic.

Subscripts which are abbreviations of words other than proper names are, as a rule, written with lower-case letters. Sometimes it is practical to use both capital and lower-case letters for such subscripts, making a difference in their significance which must be defined. Thus in a certain context a capital letter subscript may be used for the total value of a quantity and lower-case letter subscripts for its components. In another context capital letter subscripts may be used for external quantities and lower-case letter subscripts for internal ones.

**5.2.6** *Multiple Subscripts* — The use of a subscript consisting of several parts, a multiple subscript, should be avoided if possible. When a multiple subscript is used the parts should be placed on the same level. The only exception may be when a letter symbol consisting of a letter with a subscript is used as subscript, for example, for the temperature coefficient ( $\alpha$ ) of reluctance ( $R_{\mathrm{m}}$ ), then the total symbol can be written either non-simplified $\alpha_{R_{\mathrm{m}}}$ or simplified $\alpha_{R\mathrm{m}}$.

For the sake of clarity, the different parts of a multiple subscript may be separated by small spaces. Commas should usually be avoided between parts of a subscript, but may be used, if this is necessary to avoid ambiguity.

For the same purpose part of a subscript may be put within parentheses. No general rule for the order between parts of a subscript can be given, but for guidance, a part indicating the kind of quantity should be placed first, a part indicating special circumstances last. The order may thus depend upon the point of view.

**5.2.6.1** Some examples of multiple subscripts are as given below:

| | |
|---|---|
| $R_{\mathrm{m\,max}}$ | maximum value of reluctance |
| $\hat{u}_{\mathrm{bv}}$ | peak value of variable part of voltage at *b* |
| $i_{4(2)}$ | instantaneous value of the second harmonic of current in conductor 4. To make a distinction the number of the harmonic has been placed within parentheses |
| $L_{\mathrm{mn}}$ | mutual inductance |
| $Z_{12,13}$ | element in the twelfth row and the thirteenth column of an impedance matrix |
| $J_{\mathrm{3y}}$ | *y*-component of the third harmonic of current density $J$ |
| $J_{\mathrm{y3}}$ | third harmonic of the y-component of current density $J$. |

Multiple subscripts may sometimes be avoided by expressing the quantity in functional form, for example $W$ ( 3h, − 40°C ) for the energy capacity of an accumulator battery for a three-hour discharge at a temperature of − 40°C.

# APPENDIX A

( *Clause* 0.5 )

## GREEK ALPHABET

| | | | |
|---|---|---|---|
| alpha | $A\ \alpha$ | nu | $N\ \nu$ |
| beta | $B\ \beta$ | xi | $\Xi\ \xi$ |
| gamma | $\Gamma\ \gamma$ | omicron | $O\ o$ |
| delta | $\Delta\ \delta$ | pi | $\Pi\ \pi$ |
| epsilon | $E\ \varepsilon\ \epsilon$ | rho | $P\ \rho$ |
| zeta | $Z\ \zeta$ | sigma | $\Sigma\ \sigma$ |
| eta | $H\ \eta$ | tau | $T\ \tau$ |
| theta | $\Theta\ \vartheta\ \theta$ | upsilon | $\Upsilon\ \upsilon$ |
| iota | $I\ \iota$ | phi | $\Phi\ \varphi\ \phi$ |
| kappa | $K\ \varkappa\ \kappa$ | chi | $X\ \chi$ |
| lambda | $\Lambda\ \lambda$ | psi | $\Psi\ \psi$ |
| mu | $M\ \mu$ | omega | $\Omega\ \omega$ |

NOTE — In this standard different senses have not been given to the two forms of the small epsilon, theta, kappa and phi.

# APPENDIX B

( *Clause* 0.6 )

## GLOSSARY OF TERMS CONCERNING LETTER SYMBOLS

**B-0.** This glossary gives certain concepts relating to the formation of letter symbols, but does not give recommendations for application of these concepts. It is for guidance in discussing problems relating to symbols, as and when they arise.

## B-1. TERMS CONCERNING THE STRUCTURE OF LETTER SYMBOLS

**B-1.1 Letter Symbol ( for a Quantity or a Unit )** — One or more letters, printed ( or written )*, successively and without spacing, in a specified style and often provided with additional marks ( *see* **6** ), by convention representing a quantity or a unit.

NOTE — 'Letter symbol' as a technical term does not have the same meaning as either 'name' or 'abbreviation'. An abbreviation is a letter or a combination of letters (sometimes with an apostrophe or a period), which by convention represents a word or a name in a particular language, hence an abbreviation may be different in different languages.

**B-1.1.1** A symbol represents a quantity or a unit and is therefore independent of language; for example, for magnetomotive force, the symbol is '*F*', whereas the abbreviation is 'mmf' in English, 'fmm' in French 'MMK' in German. The word 'ampere' is sometimes abbreviated 'amp' in some languages; the symbol for this unit is 'A'.

NOTE — In a few special cases, non-alphanumerical signs are considered as letters in this connection,f or example, the sign '°' ( degree ), which is used as a letter symbol for a unit of angle and in the letter symbol °C for a unit of temperature.

**B-1.2 Entire Letter Symbol for a Quantity** — The combination of a letter symbol for a generic quantity ( kernel ) with additional marks ( such as subscripts ) to indicate a special case or special condition.

**B-1.3 Entire Letter Symbol for a Unit** — For a non-compound unit, formed without multiplying prefix, it is one or more basic letters ( *see* **B-1.4** ) printed in roman type.

For a compound unit it is the combination of the letter symbols for the units forming the compound, with appropriate indications of multiplication division and raising to a power.

*Where appropriate, read 'printed' as 'printed or written', throughout this Appendix.

For decimal multiples or submultiples of a unit, it is the combination of the letter symbol for the unit with the letter symbol for the prefix.

**B-1.4 Basic Letter ( of a Symbol )** — A letter of an alphabet from which a letter symbol is generated by printing the letter in a specified type. The normal style of the symbol for pressure is an italic lower case '*p*'; for power, an italic capital '*P*'; for the unit poise, a roman capital 'P'; the same basic letter is used in these, three examples.

**B-1.5 Kernel ( of a Letter Symbol for a Quantity )** — That part of an entire letter symbol which indicates the generic quantity and to which additional marks are attached. The kernel is, in general, a single basic letter printed in italic type. ( The exception to the general rule is the usage of two-letter kernels for numerical parameters such as '*Re*' for Reynolds number. ) The names of various marks that could be added to a kernel are given below:

| | |
|---|---|
| Circumflex ( caret ) | $\hat{X}$ |
| Inverted circumflex ( caron ) | $\check{X}$ |
| Tilde | $\tilde{X}$ |
| Prime | $X'$ |
| Double prime | $X''$ |
| Parentheses | $( X )$ |
| Brackets | $[ X ]$ |
| Braces | $\{ X \}$ |
| Angle brackets ( elbows ) | $\langle X \rangle$ |
| Overline | $\bar{X}$ |
| Underline | $\underline{X}$ |
| Dagger | $X\dagger$ |
| Asterisk | $X*$ |
| Arrow | $\vec{X}$ |
| Plus sign, positive sign | $X+$ |
| Minus sign, negative sign | $X-$ |

**B-1.6 Additional Marks** — Letters or signs added to a kernel. According to their position relative to the kernel ( $X$ ), the additional marks have the following designations:

$$\begin{array}{ccc} 1 & \wedge & * \\ & \bar{X} & \\ 2 & \sim & \text{max} \end{array}$$

where

‘ 1 ’ is a left superscript,

the circumflex is an overscript,

the asterisk is a right superscript,

the abbreviation ‘ max ’ is a right subscript,

the tilde is an underscript, and

‘ 2 ’ is a left subscript.

Alphanumerical additional marks are usually printed in a smaller type face than that of the kernel. Some non-alphanumerical marks are listed in **B-3**.

NOTE 1 — Any sign or mark indicating a mathematical operation is not an additional mark in the sense used in **B-2.**

NOTE 2 — The term ‘ subscript ’ is often used for ‘ right subscript ‘ if there is only one subscript.

NOTE 3 — The term ‘ perscript ’ is often used for ‘ right perscript ’. The term ‘ exponent ’s hould not be used for a right superscript that does not represent a power.

NOTE 4 — Underscripts are often used to instruct the printer as to the type fount desired; if the underscript itself is to be printed, suitable instructions shall be given to the printer.

NOTE 5 — Parentheses, brackets, braces, and angle brackets are included among additional marks

## B-2. STYLES OF LETTERS

**B-2.1 Capital ( Upper-Case ) Letter** — A style of letter used, for instance, for the initial letter of a sentence or of a proper name; the property of being ‘ capital ’ is independent of the physical size of the printed letter.

*Examples:*

A, *A*, ***A***, **A**

**B-2.2 Lower-Case Letter** — A style of letter such as is used within words; the property of being ‘ lower case ’ is independent of the physical size of the printed letter. In common parlance, the term ‘ small letter ’ is often used; confusion then arises when small capitals or large lower-case letters are required.

*Examples:*

a, *a*, **a**

**B-2.3 Italic** — Sloping type fount.

*Examples:*

*A*, *a*

**B-2.4 Roman** — Upright type fount.

*Examples:*

A, a, **A**

**B-2.5 Bold Face** — Heavy type fount, that is the printed letter is made up of wide lines giving the effect of being darker than an ordinary ( lightface ) fount.

*Examples:*

**A, a, *A***

## B-3. ILLUSTRATIVE EXAMPLES

**B-3.1 Example 1** — $I'_1$. Here $I$ is the kernel of this letter symbol; it is the symbol for a generic quantity ( electric current in this case ). The numeral 1 and the prime in this symbol are additional marks. They specify that the symbol does not represent current in general but, for example, the current through a circuit element indicated by the numeral 1, this current being considered for a special case, for example, at a special time or under certain conditions indicated by the prime '. $I'_1$ is called the entire letter symbol for the quantity. The basic letter of the symbol is the letter ' i ', this is printed in italic to indicate that it is the symbol for a quantity, and in this example, it is used in the capital form ( also called ' upper case ' ) in order to indicate that the current for which it stands is not an instantaneous value but a root-mean-square value. An additional mark in the position of the 1 in the example is called a subscript; one in the position of the ', a superscript. Letters and numerals in additional marks are usually printed in a smaller type face than that of the kernel.

**B-3.2 Example 2** — kW/m². Here the basic letter 'w', used in the upper-case form and printed in roman type 'W' is the symbol for the unit 'watt'. The basic letter 'm', used in the lower-case form and printed in roman type, is the symbol for the unit 'metre'. The combination W/m², with the oblique stroke for division and the right superscript ' 2 ' for raising to the second power, is the symbol of the compound unit, watt per square metre. The prefix ' k ' indicates the multiple $10^3$.kW/m² is the entire letter symbol for the unit.

**B-3.3 Example 3** — $Re_3$. Here the kernel of the letter symbol in this case is *Re,* standing for Reynolds number. It consists of the joint letters capital italic ' *R* ' and lower-case italic ' *e* '. In addition, the example has a right subscript ' 3 ', serving to make a distinction from the Reynolds numbers for other cases.

# APPENDIX C

( *Clause* 4.5 )

## REPRESENTATION OF NUMERICAL VALUES

### C-1. SPACING OF GROUPS OF DIGITS

**C-1.1 Numerals of More than Three Digits** — Such numerals shall be given in groups of three with a short space between every two consecutive groups; the grouping shall start from the unit digit towards left when there is no decimal point, but when there is a decimal point, the grouping shall be made in both the directions from the decimal point. The use of punctuation marks like commas for breaking up numerals shall be avoided.

*Examples* :

| | | |
|---|---|---|
| Incorrect — | 1) | 5,716,500 |
| | 2) | 76252 54.37 842 |
| | 3) | 251 6.7 |
| | 4) | 2.01 356 |
| | 5) | .1256 73 |
| Correct — | 1) | 5 716 500 |
| | 2) | 7 625 254.378 42 |
| | 3) | 2 516.7 |
| | 4) | 2.013 56 |
| | 5) | 0.125 673 |

**C-1.2** Under certain circumstances, such as in the case of date, designation of a standard, hour of the day, etc, a four digit numeral may be written without short spacing.

*Examples* :

1) 14 May 1956
2) IS : 1032-1957
3) 1 000 h

### C-2. DECIMAL SIGN

**C-2.1** A dot (·) shall be used for decimal sign.

**C-2.2** A zero shall appear before the decimal point if it is not preceded by a numeral.

### C-3. MULTIPLICATION SIGN

**C-3.1** The sign of multiplication of numbers is a cross (×).

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